the signals that these subjects would emit" (p. 3, lns. 23-24). As stated in each independent claim, the waveform that is generated is a "waveform that simulates a waveform of a subject undergoing a magnetic resonance scan" (claims 1, 11, 20 and 25).

This active phantom provides several advantages. For example, since it is a direct source of a waveform, it does not need the RF generation system of the MR scanner to operate. Thus, one advantage is that it can be used to control for possible problems in the RF generation system of the MR scanner, providing improved troubleshooting and system calibration (p. 2, ln. 28 to p. 3, ln. 2). This active phantom can also be used to bypass the receiving antenna in the MR scanner. A benefit of this approach is that this permits testing to detect if there is a problem with the antenna in the MR scanner (p. 3, lns. 3-6). In addition, the active phantom can be programmable, providing the ability to simulate the waveforms of different subjects and even to perform dynamic adjustments to the waveforms being generated (p. 3, ln. 25 to p. 4, ln. 3). Furthermore, it can generate waveforms stored on magnetic or optical storage media, and it can include a "record" feature to record waveforms to be generated at a later time (p. 5, lns. 1-10).

The Cited Art

Examiner has rejected claims 1-36 under 35 U.S.C. 103(a) as being unpatentable over Hurd (US 6,242,915), and further in view of Shaefer et al (US 4,719,406). Hurd teaches a particular feature, a field-frequency lock system, which is added on to a standard MRI system. This field-frequency lock system uses a microcoil and a resonant sample to sense changes in the polarizing magnetic field. The changes that are detected are used to produce corrective signals to perform adjustments during scanning. The Abstract in Hurd briefly summarizes the field-frequency lock system:

> A field-frequency lock system for an MRI system includes a microcoil and resonant sample located to sense changes in the polarizing magnetic field. Changes are detected as a shift in frequency of the NMR signal produced by the resonant sample, and the frequency shift is used to compensate the MRI system. Compensation is achieved by adjusting the RF reference signal employed in the MRI system transceiver.

The Summary of the Invention describes the field-frequency lock system in more detail (col. 2, lns. 37-51). Figure 1 in Hurd shows a standard MRI system including Hurd's field-frequency lock system. This figure shows the field-frequency lock system and the microcoil that is used in this system to measure the variations in the polarizing magnetic field to produce a corrective signal (col. 4, lns. 1-4 ("The lock system 129 operates with a microcoil 130 to measure variations in the polarizing magnetic field strength B_0 and produce a corrective signal to the CPU module 119 in the system control 122.")).

Schaefer teaches a type of traditional "passive" phantom for use in a MRI (or NMR) scanner. This passive phantom is made up of a housing composed of substantially non-NMR-active material. Schaefer discloses placing two NMR-active media in this housing. NMR signals are produced when this passive phantom is excited by RF pulses during a scan sequence in the MR scanner. The Abstract and the first paragraph of the Summary of the Invention (col. 2, lns. 40-60) explain this structure and operation of Schaefer's passive phantom. Figures 1 and 2 are examples of passive phantoms having the particular structure taught by Schaefer.

The Claims are Not Obvious in Light of Hurd and Schaefer

Even viewed together (assuming without conceding that a person of ordinary skill in the art would be motivated to combine them), Hurd and Schaefer do not disclose the claimed inventions. They do not meet all the limitations of the independent claims.

Hurd discloses a field-frequency lock system that is added on to a standard MRI system. Schaefer discloses a passive phantom that only produces MR signals when excited by RF pulses during a scan sequence. Taken together, Hurd and Schaefer would disclose scanning the passive phantom of Schaefer with an MR system including Hurd's field-frequency lock system. This amounts to using a modified MR scanner to scan a particular type of traditional passive phantom. This is very different from the inventions claimed in the present application.

The independent claims in the present application relate to an active phantom that generates its own "waveform that simulates a waveform of a subject undergoing a magnetic resonance scan" (claims 1, 11, 20 and 25). This is completely different from the combination of

Hurd and Schaefer—scanning a traditional passive phantom with an MR scanner including a field-frequency lock system.

Both Hurd's field-frequency lock system and Schaefer's passive phantom only function when an MR scan is being performed. Thus, either independently or taken together, Hurd and Schaefer involve features that only work when an MR scan is being performed. By contrast, as stated above, the active phantom of the present application generates its own waveform and therefore does not require an MR scan to be performed. Thus, Hurd and Schaefer together do not disclose the active phantom of the present application.

Examiner is correct that "Hurd does not teach a waveform simulating a waveform of a subject undergoing a magnetic resonance scan." In fact, Hurd has nothing to do with simulation. Hurd teaches a field-frequency lock system to generate corrective signals to improve scanning of a real subject (co. 2, lns. 37-51). Schaefer teaches a passive approach to simulation. Schaefer teaches a particular device that holds NMR-active media that can be excited by RF pulses in an MR scanner. Thus, neither reference alone or in combination teaches the active approach claimed by Applicant, where a waveform is generated without requiring any MR scan to be performed.

Conclusion

Applicant respectfully submits that all independent claims (claims 1, 11, 20, and 25) are in condition for allowance for the reasons explained above. Therefore, the dependent claims are also in condition for allowance. Accordingly, since Applicant submits that all pending claims should be allowed for the reasons explained above, Applicant has not addressed Examiner's positions regarding the dependent claims because Applicant believes this is not necessary. In doing so, Applicant does not imply agreement with Examiner and does not intend any surrender of rights.

Enclosed is a $210.00 check for the Petition for Extension of Time fee. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: 2/5/04

Charles H. Sanders
Reg. No. 47,053

Fish & Richardson P.C.
225 Franklin Street
Boston, MA 02110-2804
Telephone: (617) 542-5070
Facsimile: (617) 542-8906

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